AN AERIAL SURVEY FOR BEAVERS
IN THE SAHTU SETTLEMENT AREA
OCTOBER 1997

Northwest Territories Resources, Wildlife & Economic Development

103-06802/

AN AERIAL SURVEY FOR BEAVERS IN THE SAHTU SETTLEMENT AREA OCTOBER 1997

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Norman Wells, NWT.

1998

Manuscript Report No. 108

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ABSTRACT

An aerial survey of beaver *(Castor canadensis)* lodges in three study blocks within the Sahtu Settlement Area was flown in a fixed-wing aircraft in October 1997. The total surveyed area was 266 km^2. One hundred and fifty-three active lodges were found, a density of 58 active lodges/100 km^2. In addition, 147 inactive lodges were found, a density of 55 inactive lodges/100 km^2. Comparison with a similar survey for the same study blocks in 1989 indicates that the lodge density in the study blocks approximately doubled from 26 active lodges/100 km^2 in 1989. Two blocks had an increase and one block had a slight decrease in the density of active lodges. In comparison to North American beaver lodge densities, beavers in the Sahtu are at moderate levels. Continued long-term monitoring of beaver abundance is recommended by repeating this survey in September 2001.

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INTRODUCTION

Fur was the most important export from the Northwest Territories (NWT) until 1946 when mineral and oil production took precedence (Science Advisory Board of the NWT 1980). Intense competition among trappers during times of high fur prices caused declines in beaver *(Castor canadensis)* populations over much of their range in North America (Novak 1987). The Northwest Game Act of 1917 established a legislation framework for the setting of closed trapping seasons for furbearers and trapping license requirements in the NWT. It also established the registration of group-trapping areas to protect Aboriginal peoples' access to fur (e.g., the Fort Good Hope Registered Group Trapping Area).

The Government of the NWT (GNWT) maintains records on the quantity and value of NWT furs sold. These records are assumed to represent most of the commercial beaver harvest and they show that the NWT beaver harvest has fluctuated widely. The maximum-recorded sale of 15,553 pelts occurred in 1940-41 when the average pelt price for beavers was $60.33 (Department of Resources, Wildlife and Economic Development, unpublished data). When the average pelt price dropped to $14.00 in 1990-91, the number of pelts sold dropped to 1,277 (Table 1).

The Sahtu Settlement Area, which covers approximately 283,000 km^2 of the western NWT, is the land claim area of the Sahtu Dene and Metis. *The Sahtu Dene and Metis Comprehensive Land Claim Agreement* (1993) was signed by Sahtu Dene and Metis and the governments of the NWT and Canada. It identifies the Sahtu Renewable Resources Board (SRRB) as the main instrument for wildlife management in the Sahtu. Current

beaver management within the Sahtu is by regulation of trapping licenses and season length, and monitoring the numbers of active lodges in study blocks. The primary beaver manager is the trapper who decides how many animals to harvest from each lodge.

The primary furbearers harvested in the Sahtu during the 1997-1998 trapping season (15 October to 15 June) were: marten *(Martes americanus)*, wolverine (*Gulo gulo*), beaver, and gray wolf (*Canis lupus*). Other furbearers in the area include: mink (*Mustela vison*), red fox (*Vulpes vulpes*), muskrat (*Ondatra zibethicus*), black bear (*Ursus americanus*), lynx (*Lynx lynx*), red squirrel (*Tamiasciurus hudsonicus*), ermine (*Mustela erminea*), arctic fox (*Alopex lagopus*), otter *(Lutra canadensis*), and grizzly bear (*Ursus arctos*). Population levels and trends for most of these species are unknown.

The economic importance of beavers to trappers in the Sahtu Settlement Area is variable. The highest recorded level of beaver pelt sales from a single Sahtu community occurred in 1958 when the people of Fort Good Hope sold 1060 beaver. Trappers were restricted by beaver quotas between 1951 and 1969 when fur prices were high (Dene Cultural Institute 1995). The 1996-97 beaver harvest in Sahtu was 269 pelts with an average price of $29.95. Fur records over the past 35 years show that the Sahtu produces about 15% of all beaver pelts sold from the NWT and that the average pelt price for Sahtu beavers is 12% above the NWT average (Table 1). Currently there is a strong demand for heavy beaver pelts suitable for shearing. Beaver pelts recently sold for an average of $29.75 and a top price of $71.00 at Western Canadian Raw Fur Auction Sales Ltd. in Vancouver, BC (July 1998).

Sahtu hunters and trappers also harvest beavers to meet their domestic needs for food and fur. This year the Sahtu Renewable Resources Board (SRRB) initiated a five-year harvest

study to determine the total harvest of all wildlife species by beneficiaries of the Sahtu Land Claim.

Numerous aerial surveys for beavers have been done in the western NWT since 1947 and Boles (1975) summarized those to 1974. Aerial surveys enable large, remote areas to be surveyed quickly and economically (Fuller 1953). Dennington and Johnson (1974) estimated a mean of 24 active beaver lodges/100km^2 in lake habitat in the southwestern NWT. Mackenzie River delta beaver populations declined from ca. 38 beaver lodges/ 100 km ^{2} in 1962 to 15 lodges/100 km^2 in 1968. This decline was attributed to deteriorating food conditions (Aleksiuk 1970). The Science Advisory Board of the NWT (1980) recommended long-term monitoring of beaver population densities with comparisons to harvest records in order to obtain baseline data for management purposes. Poole and Croft (1990) completed the last extensive beaver lodge surveys in the western NWT in 1989 and they reported a mean active beaver lodge density of 26 lodges/100 km^2.

STUDY AREA

The study blocks are located in the boreal forest/taiga ecosystem within the Mackenzie River valley. The primary tree species found in the area are: black spruce (*Picea mariana*), white spruce (*P. glauca*), tamarack *(Larix laricina*), poplar (*Populus* spp.), white birch *(Betula* spp.), and willows *(Salix* spp.). White spruce and poplar are common on the well-drained uplands while black spruce and tamarack generally occur in lowlands and muskegs.

The Mackenzie River valley is a relatively flat to rolling plain characterized by discontinuous drainage patterns, eroded limestone landforms, and soils underlain with permafrost. Lightening-caused forest fires maintain early successional stages of white birch, white spruce, and poplar uplands and a heterogeneous mixture of black spruce, tamarack, willows, Labrador tea (*Ledum groenlandicum*), shrubs, and forbs at various stages of plant succession and regeneration. Lowlands are typically covered with peat and numerous small ponds, lakes, bogs, or palsa. The proximity of a stable water body to deciduous trees usually defines suitable beaver habitat (Dennington and Johnson, 1974).

Based upon their local knowledge of beaver densities and harvesting, Wildlife Officers (GNWT), and the Renewable Resources Councils in Fort Good Hope, Tulita, and Norman Wells, selected one beaver study block near each of their communities in 1989 (Poole and Croft 1990). The blocks varied in size and shape according to their drainage patterns (Table 2). The total area surveyed was 266 km^2. We chose the same blocks for this survey.

METHODS

On October 4 and 6, 1997, a fixed-wing aircraft survey of beaver lodges was flown within the Sahtu Settlement Area of the Mackenzie River valley, NWT. A *Maule Lunar Rocket* on floats and capable of short-take-off and landing was used for this survey. Floats allowed for stops to minimize observer fatigue and provide increased safety in case of inclement weather or an emergency landing.

We flew the same three study blocks that were surveyed in 1989 by Poole and Croft (1990). The flight path followed the shoreline of all ponds, lakes, creeks, and river reaches within each block. The aircraft was flown at ca. 100 km/h. All watercourses were flown at ca. 100 m above ground level.

The front seat observer and pilot navigated via 1: 50,000 scale topographic maps and a global positioning system (GPS). The front observer also classified beaver lodges as either active or inactive. The rear seat observer assisted with the location and classification of the beaver lodges.

We timed the survey to occur between leaf-fall and freeze-up, since this period allows for optimal visibility of fresh feed piles (Payne 1981). The primary criterion for an active lodge was the presence of a fresh feed pile within 150 m of the lodge. Other criteria used to locate and identify active lodges included: dams, high water levels in ponds, fresh cuttings, fresh mud on a lodge, or sightings of beaver. Active and inactive lodge locations were recorded on 1: 50,000 scale topographic maps.

Copies of the survey maps and summary data were provided to interested trappers in an effort to encourage beaver harvesting. In addition, results of the survey were presented to the Sahtu Renewable Resources Board, and to the Renewable Resources Councils in Fort Good Hope, Tulita, and Norman Wells.

Following completion of the survey, we classified the density of active beaver lodges in our study blocks as: low (0 – 29 lodges/100 km^2), medium (30 - 59 lodges/100 km^2), or high (> 60 lodges/100 km^2). The range of beaver lodges densities reported for the Mackenzie Delta by Aleksiuk (1970) is 15 to 38 lodges/100 km^2.

RESULTS

Unusually warm temperatures during September 1997 delayed leaf-fall and the start of the survey until the fourth week of September. Local snow squalls and poor visibility on October 5, 1997 interrupted the survey; however, weather conditions and visibility on October 4 and 6 were suitable. Winds were light and temperatures ranged from 1^0C to 7^0C. While snow showers were encountered between survey blocks, they were not a factor within the blocks. Visibility and contrast were good during the survey flights. Freeze-up and snowfall on smaller lakes and ponds began on October 5, 1997; therefore, we had a narrow window-of-opportunity to fly the survey.

The aerial survey was flown over 12 h on 4 and 6 October 1997. The survey required 6.3 h within the survey blocks and 5.7 h for travel to, from, and between survey blocks.

Totals of 153 active and 147 inactive lodges were located (Table 2). High densities of active beaver lodges were found at Willow Lake (69 lodges/100 km^2) and Ramparts (85 lodges/100 km^2). Oscar Lake had a low density of 21 active lodges/100 km^2. The density of inactive lodges was moderate at Oscar Lake (32 lodges/100 km^2) and Ramparts (39 lodges/100 km^2). A high density of inactive lodges was found at Willow Lake (88 lodges/100 km^2).

Sign of beaver activity was clearly visible and abundant at active lodges. Some of the fresh feed piles were topped with spruce layered on top of poplar, white birch, willows, and unidentified woody cuttings.

Other wildlife seen during this survey were: three moose (*Alces alces*) and two black bears *(Ursus americanus).* Numerous muskrat dens were found in one pond in the Willow Lake block and another pond in the Oscar Lake block.

DISCUSSION

This survey was based upon the recommendation from Poole and Croft (1990) that a general trend indicator of beaver abundance can be obtained quickly and economically by repeating aerial surveys spaced at four-year intervals. They suggest that monitoring the number of active beaver lodges is a reasonable indicator of beaver population trends. We duplicated their survey method except for a change in aircraft type. The *Maule Lunar Rocket* was a locally available, affordable aircraft that met the survey's flying requirements. The cost per location for active beaver lodges in our survey blocks was $10.87, about one-fourth the cost of a *Bell 206* helicopter charter.

Estimates of beaver lodge density across North America vary from 15 to 390 active lodges/ 100 km^2 (Novak 1987). Since 1989, the average density of active lodges in the Sahtu survey blocks has increased from 43 to 58/100 km^2 (Table 3). This is about double the average density of active beaver lodges reported for the western NWT in 1989 (Poole and Croft 1990). This increase may be a result of the current low level of beaver harvesting activity within the Sahtu.

Water and food supply limits the distribution of beaver (Novak 1987). Sahtu beavers rely upon their feed piles as their main source of food for up to eight months each year while they are under the ice. Usually, there is only one fresh feed pile per active beaver lodge (Fuller 1953). Beavers are generalist feeders with a preference for poplar, birch, and willow (Novak 1987). Our observation of conifers in some feed piles, particularly in the Oscar Lake block, may be indicative of habitat over-use by beavers; however, beavers often

use non-food and low preference food items to cap-off a feed pile to secure the availability of preferred feed under the ice (Slough 1978).

The number of inactive lodges has doubled from 28/100 km^2 in 1989 to 55/100 km^2 in 1997 (Table 3). This increase may be a result of heavy-utilization of available feed and dispersal to sub-optimal habitat. Dispersal is generally along waterways, sometimes overland, and may be extensive (Wheatley 1997). During periods of high beaver density, dispersing individuals may occupy marginal habitat such as shallow ponds that often freeze-up available feed and generally result in starvation (Payne 1984*a*).

A beaver family may abandon their lodge if their food supply becomes depleted (Hall 1971 *in* Novak et al. 1987), water level fluctuates (Nixon and Ely1969 *in* Novak et al. 1987), or as a result of mortality within the family. Hunting or trapping is generally the primary mortality factor. Other mortality factors include: predation, diseases, parasites, accidents, severe winter weather conditions, and low winter water levels that may lead to starvation (Payne 1984*a*). Beaver harvesting in the study areas is currently very low. Lodges without fresh feed-piles and classified as inactive may be used during the summer (M. Wheately, pers. comm.). We suggest that some of them are abandoned lodges as a result of local habitat deterioration from over-use.

Survey accuracy may vary with habitat type, weather, observer fatigue, visibility, and aircraft speed, altitude, and type. Payne (1981) found that ground counts of beaver colonies in Newfoundland were 19% greater than helicopter surveys, and 39% greater than fixed-wing surveys. However, fixed-wing aerial surveys of active beaver lodges may find as many as 90% of the lodges found by ground surveys (Swenson et al. 1983).

Beaver population assessments based upon aerial surveys of active lodges requires data on the number of beaver per lodge and survey accuracy (Payne 1982). Novak (1987) documented that beaver family size varies from 3.2 to 8.2 across North America. The average number of beaver per lodge within the Sahtu is unknown. This year the SRRB started a research program to estimate family size and composition in representative beaver lodges at the Hume - Ramparts and Willow Lake areas and to estimate dispersal distances of beaver in the SSA (M. Wheately, pers. comm.). Hopefully, the results of the SRRB studies will enable accurate estimates of beaver population sizes to be calculated from future aerial surveys of beaver lodges in Sahtu.

At current harvest levels in the Sahtu - 269 pelts in 1996/97 at an average price of $29.95 - an index of population trend is sufficient for management requirements. Intensive beaver management would require data on the age, sex structure, and age-class reproduction of a population (Swenson et al. 1983).

Beavers in our study areas are an abundant and potentially valuable fur resource. Beaver populations throughout much of the Sahtu and NWT are considered to be underutilized (K. Hickling, pers. comm.). The current level of beaver pelt sales is likely a result of changes in trapping effort related to their market value and alternative income sources for former trappers, rather than a result of changes in the numbers of beaver available (Table 3). Under-ice trapping for prime beaver is often perceived to be the least profitable to a commercial trapper due to the effort required (Check 1991), particularly when more profitable and easily trapped species, such as marten, are abundant.

A study on traditional environmental knowledge in Fort Good Hope found that trappers know that beaver get scarce when they are not harvested (Dene Cultural Institute 1995). Many Sahtu hunters and trappers believe that harvesting of animals is necessary to achieve productive populations that can provide sustainable benefits to the people (Hara 1980). Beaver harvesting can be used as a means to increase beaver populations as beaver fecundity is density-dependent (Boyce 1981). Harvest may prevent the overuse of food supply, reduce competition for food and space, or increase reproduction rates and the survival of young (Payne1984*b*).

Some beaver populations can support a harvest rate of 25-30%, where whole colonies are removed on a multiple year rotation (Hatler 1988). Therefore, the Sahtu beaver harvest could be increased substantially.

To encourage and support trappers, the GNWT currently guarantees a minimum price for prime, well-handled pelts of certain species shipped to the fur auctions (G. Erasmus, pers. comm.). For beavers, the trapper is guaranteed $40.00. Beaver pelts are prime between November and March, although this varies with latitude (Novak 1987). The beaver trapping season in the Sahtu Settlement Area is open from 15 October to 31 May; except for the Fort Good Hope Registered Group Trapping Area, which is open from 20 October to 5 June.

RECOMMENDATIONS

1. Continue long-term monitoring of beaver feed pile abundance by repeating this survey after leaf-fall and before freeze-up in September 2001.

2. Promote trapping of prime beaver through trapper training workshops on techniques for harvesting beaver under the ice.

3. Incorporate the results of current beaver studies by the SRRB to produce estimates of actual numbers of beavers present in the Sahtu study area as represented by the aerial survey to quantify active lodges.

ACKNOWLEDGEMENTS

The Renewable Resources Councils in Tulita, Fort Good Hope, and Norman Wells provided their approval and support for this survey.

Blair Jensen, pilot and owner of *Ursus Aviation,* capably demonstrated his ability to maneuver the airplane during the survey flights.

Lana Leverington, GIS Specialist with the Sahtu Geographic Information System, produced maps and slides used in public presentations of our results.

Robert Nowosad and Michelle Wheatley of the Sahtu Renewable Resources Board assisted as observers on October 4 and 6, respectively.

Michelle Wheatley and Bruce MacDonald (SRRB) reviewed a draft of this report and provided useful suggestions.

PERSONAL COMMUNICATIONS

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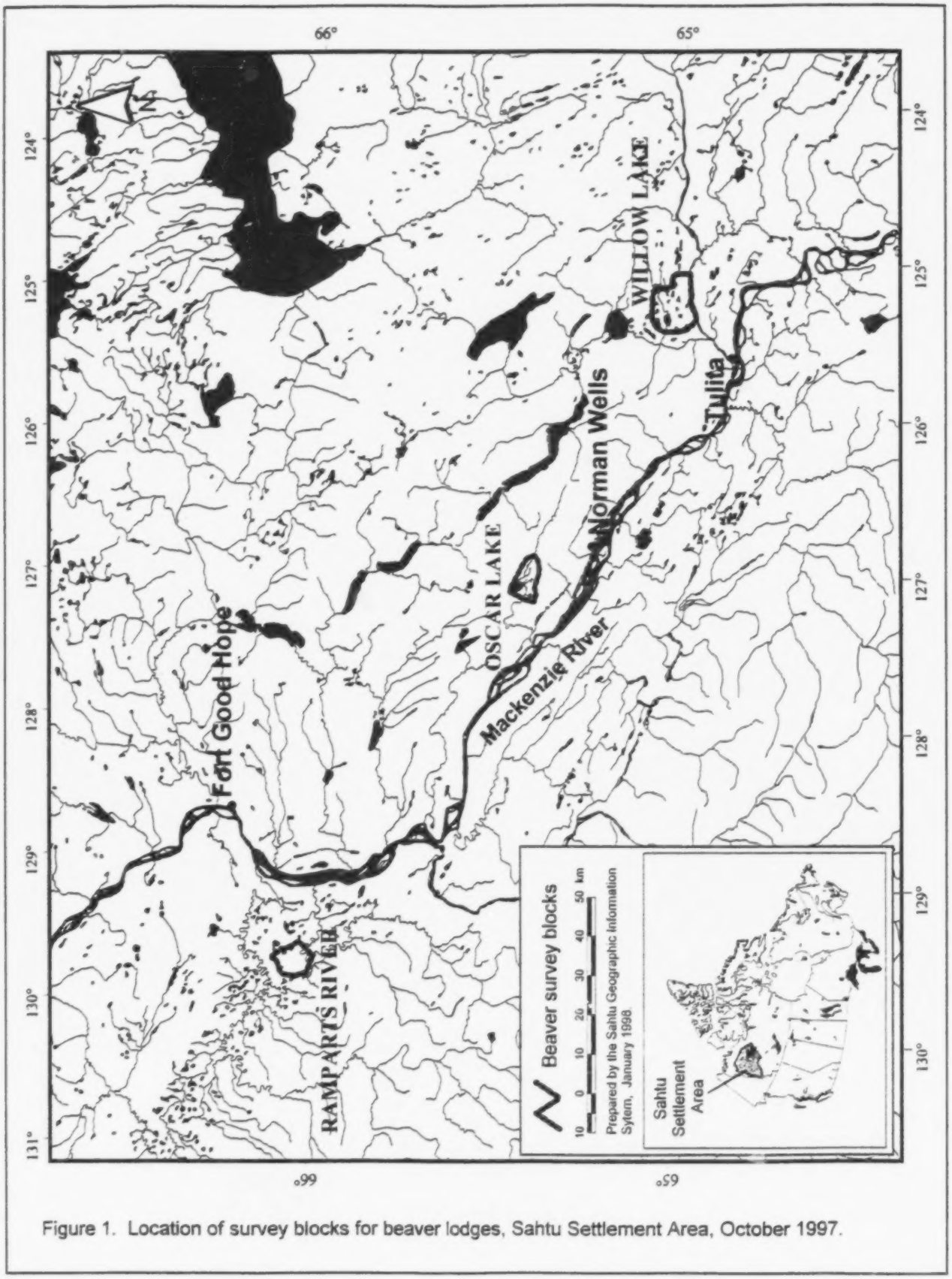

Figure 1. Location of survey blocks for beaver lodges, Sahtu Settlement Area, October 1997.

Table 1. Beaver pelt sales in the Sahtu Settlement Area and NWT: 1963-1997.

Year	Number of pelts NWT	Average pelt value NWT ($)	Total Sales NWT ($)	Number of pelts Sahtu	Average pelt value Sahtu ($)	Total Sales Sahtu ($)
1993 - 1997	2026	24	48, 624	206	27	5562
1988 - 1992	1828	14	25, 592	348	19	6612
1983 - 1987	3199	21	67, 179	357	20	7140
1978 - 1982	5046	23	116, 058	939	22	20, 658
1973 - 1977	4210	15	63, 150	838	15a	12, 570
1968 - 1972	7406	14	103, 684	1282	14a	17, 948
1963 - 1967	9186	11	101, 046	1371	11a	15, 081
Average	4862	17	82, 654	684	22	15, 048
Lowest year	1990 @1277	1964 @ 10	1990 @ 17, 878	1993 @ 89	1964 @ 10	1993 @1180
Highest year	1963 @ 10, 349	1995 @ 30	1979 @ 276, 469	1980 @ 2143	1996 @ 32	1980 @ 57, 968

Assumes that the average pelt value for Sahtu 1963 - 1977 was the same as the NWT average pelt value for 1963 - 1977.

Source of information:
Government of the NWT, Department of Resources, Wildlife and Economic Development, unpublished data.

Table 2. Active and inactive beaver lodges found in an aerial fixed-wing aircraft survey of three study blocks, in the Sahtu Settlement Area, October 1997.

Survey block	Willow Lake	Oscar Lake	Ramparts
Area (km^2)	98	92	76
Date Surveyed	04-Oct-97	04-Oct-97	06-Oct-97
Survey time	2 h 59 min	1 h 30 min	1 h 49 min
Number of active lodges	68	20	65
Density/100 km^2	69	21	85
Number of inactive lodges	87	30	30
Density/100 km^2	88	32	39
Number of active lodges per hour flown	23	13	36
Number of active & inactive lodges per hour flown	52	33	52

Table 3. A comparison between September 1989 and October 1997 aerial fixed-wing aircraft surveys for beaver lodges within the Sahtu Settlement Area, NWT.

Survey block	Survey year	Area (km^2)	Active (N)	Lodges (#/100 km^2)	Abandoned (N)	Lodges (#/100 km^2)	Population trend
Oscar Lake	1989	92	23	25.0	14	15.0	decrease
	1997	92	20	22.0	30	33.0	
Ramparts	1989	76	44	58.0	22	29.0	increase
	1997	76	65	86.0	30	4.0	
Willow Lake	1989	98	49	5.0	39	4.0	increase
	1997	98	68	69.0	87	89.0	
NWT Total	1989	2059	545	26.0	289	14.0	
Sahtu Total	1989	266	116	43.0	75	28.0	
	1997	266	153	58.0	147	55.0	